Centre Number	Candidate Number	Name

CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

COMBINED SCIENCE
CO-ORDINATED SCIENCES

0653/06, 0654/06

Paper 6 Alternative to Practical Test

October/November 2003

1 hour

Candidates answer on the Question Paper.
No Additional Materials are required

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen in the spaces provided on the Question Paper.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.
At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

If you have been given a label, look at the details. If any details are incorrect or missing, please fill in your correct details in the space given at the top of this page.

Stick your personal label here, if provided.

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1	
2	
3	
4	
5	
6	
Total	

This document consists of **18** printed pages and **2** blank pages.

SP (AT/SLC) S42208/3

UNIVERSITY of CAMBRIDGE
Local Examinations Syndicate

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1 A student did an experiment to find if alcohol has an effect on the rate of heartbeat of water fleas. The water fleas are so small that they have to be studied using a microscope. The heart can be seen easily in the place shown in Fig. 1.1.

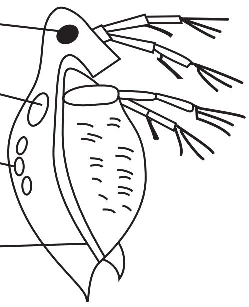

Fig. 1.1

- He placed a water flea onto a microscope slide and counted the number of heart beats in 15 seconds.
- Using a pipette he removed the water surrounding the flea and replaced it with 1% alcohol.
- He counted the new rate for 15 seconds.
- He repeated this procedure with a different flea.
- He then did the experiment with two more fleas in alcohol solutions of different concentrations shown in the table.
- He multiplied each reading by four to give the heart rate per minute.
- He recorded his results in the table, Fig. 1.2.

alcohol concentration / %	first reading of heart rate / beats per minute	second reading of heart rate / beats per minute	average heart rate / beats per minute
0	204	216	
1	188	196	
2	168	180	
3	140	152	
4	96	88	
5	44	48	
6	36	32	
7	20	28	
8	24	12	

Fig. 1.2

(a) Complete the table by calculating the average heart rate for each alcohol concentration. [2]

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(b) Plot a graph of average heart rate against alcohol concentration on the grid provided.

average heart rate / beats per minute

alcohol concentration / %

[3]

(c) Describe how alcohol affected the heart rate of the water fleas,

(i) at alcohol concentration between 0% and 2%,

....

....

(ii) at alcohol concentrations between 3% and 5%.

....

....[2]

(d) The nervous system controls the heart rate in both fleas and humans. Suggest how drinking alcohol affects the speed of response of the human nervous system.

....

....[1]

(e) **(i)** Suggest **one** possible source of error in the experiment.

....

....

(ii) Suggest **one** way in which the experiment could be improved.

....

....[2]

Question 2 can be found on page 6

[Turn over

2 Three students each set up an experiment using the apparatus shown in the diagram, Fig. 2.1.

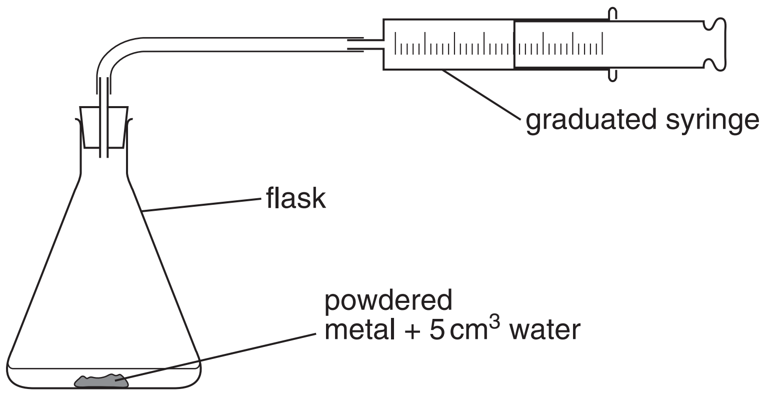

Fig. 2.1

- Each of the 100 cm^3 flasks contained a small mass of one of the metals **X**, **Y** or **Z** with 5 cm^3 of water.
- At first, all the syringes were set at the 25 cm^3 mark.
- The flasks were left for one week.
- The students recorded their results in the table, Fig. 2.3.

(a) Fig. 2.2 shows the scales of the syringes after one week.

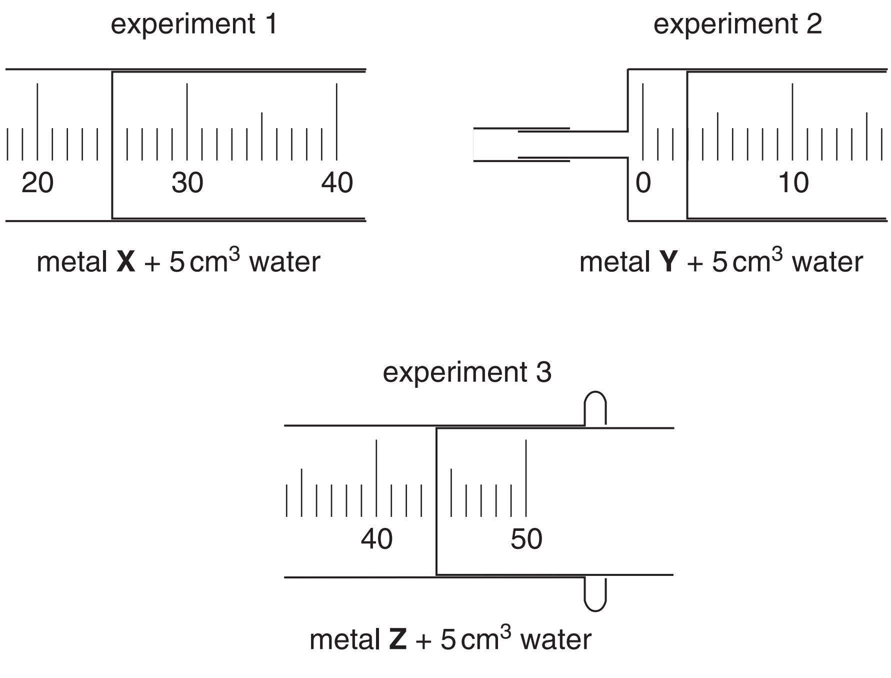

Fig. 2.2

Record the readings of the syringes in the table, Fig. 2.3.

experiment number	flask contained	syringe reading on day 1 / cm^3	syringe reading after one week / cm^3
1	metal **X** + 5 cm^3 of water	25	
2	metal **Y** + 5 cm^3 of water	25	
3	metal **Z** + 5 cm^3 of water	25	

[3]

Fig. 2.3

(b) Suggest the names of the metals used in the experiments 1–3. Choose from the following list of metals. (there may be more than one correct answer each time)

calcium copper iron magnesium zinc

Explain your answers.

(i) Metal **X** could be ....

explanation ....

....[1]

(ii) Metal **Y** could be ....

explanation ....

....[2]

(iii) Metal **Z** could be ....

explanation ....

....[2]

(c) Name the gas made by the reaction in experiment 3.

....[1]

3 A student did an experiment to investigate the solubility of potassium nitrate in water at different temperatures.
The student placed 7.0 g of potassium nitrate and 4.0 cm^3 of water in a large test-tube.

- He heated the test-tube in a water bath until all the crystals had dissolved.
- He allowed the test-tube to cool and gently stirred the contents with the thermometer.
- When he saw small shiny crystals in the solution, he recorded the temperature in the results table, Fig. 3.2.
- He added 1.0 cm^3 of water to the test-tube and stirred the mixture.

Then the steps shown above were repeated to find another temperature at which crystals began to appear.

He added 1.0 cm^3 portions of water to the tube until the total volume of water was 12.0 cm^3. Each time he found the temperature at which crystals began to appear.

Fig. 3.1 shows the scale of the thermometer for three of the experiments.

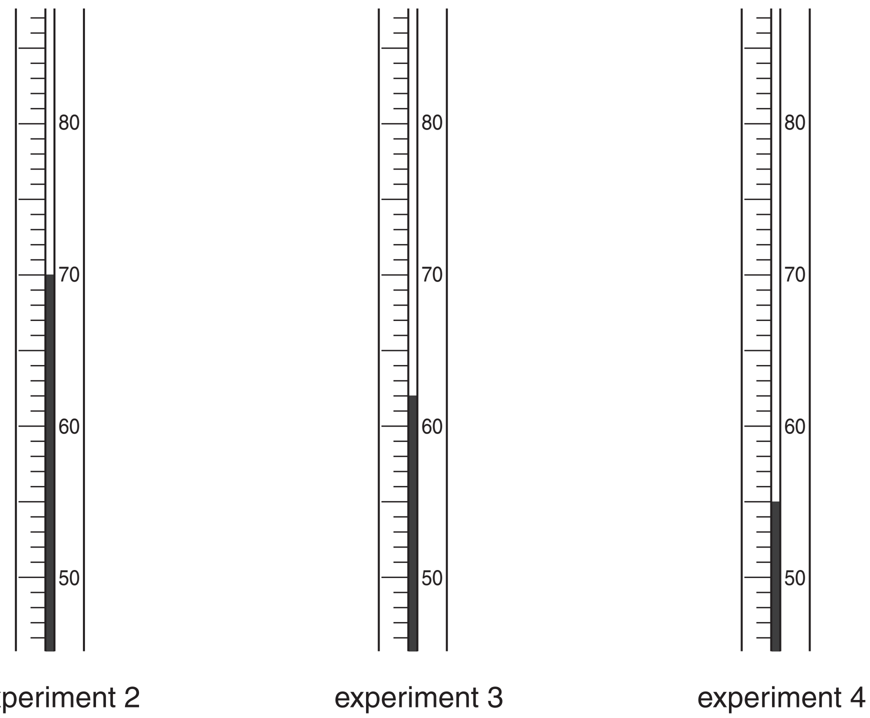

Fig. 3.1

(a) Read the thermometers in Fig. 3.1 and record the results in the table, Fig. 3.2.

experiment number	total volume of water / cm^3	mass of potassium nitrate / g	mass of potassium nitrate per 100 cm^3 of water / g	temperature / °C
1	4.0	7.0	175.0	78
2	5.0	7.0		
3	6.0	7.0	117.0	
4	7.0	7.0	100.0	
5	8.0	7.0	87.5	50
6	12.0	7.0	58.3	38

[3]

Fig. 3.2

(b) Complete Fig. 3.2 by calculating the missing value for the mass of potassium nitrate in 100 g water. [1]

(c) On the graph grid provided, Fig. 3.3, plot a graph of mass of potassium nitrate per 100 g water (vertical axis) against temperature. Draw a smooth curve. [3]

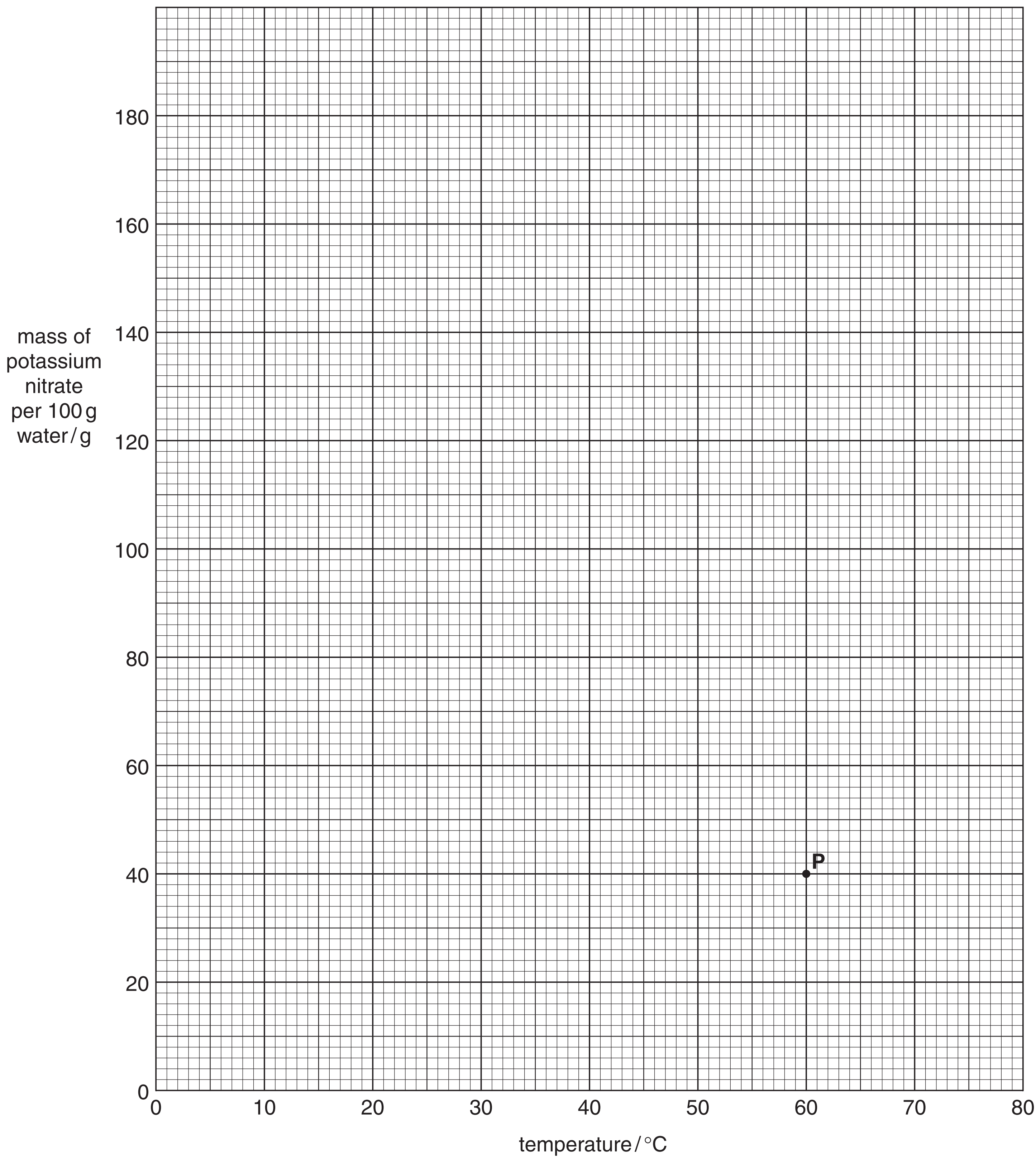

Fig. 3.3

(d) A point **P** has already been marked on the graph grid. Study the graph and then complete the following sentence about point **P**.

The point P represents a solution of .... g potassium nitrate in .... g of water at a temperature of .... °C. [1]

(e) The student wants to get solid potassium nitrate from the solution. Explain carefully how he can do this.

....

....

....[2]

4 This question is about heat loss in animals. During cold weather some animals group together (huddle) to keep warm.
A student did an experiment to find how effective such huddling is.
She used test-tubes of hot water to represent the animals.

- She half-filled eight test-tubes with hot water.
- She used an elastic band to make a bundle of seven tubes with test-tube **A** surrounded by six other test-tubes.
- She put a thermometer into test-tube **A**.
- She also put a thermometer into the eighth test-tube, **B**, which she kept separate.
- She then put the tubes in beakers as shown in the diagram, Fig. 4.1.
- Then she took the initial temperature of the water in both test-tubes. She continued to take the temperature **every minute for ten minutes**.

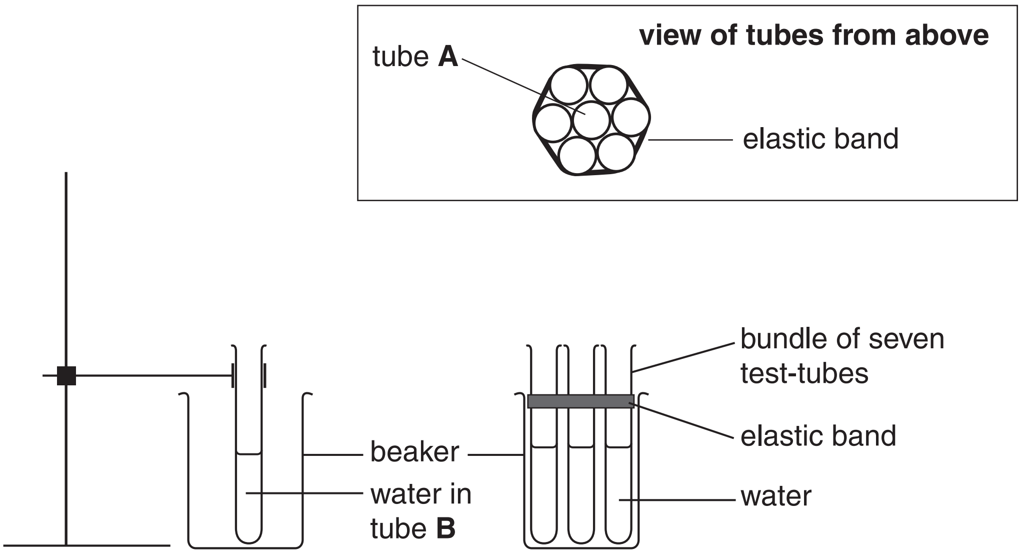

Fig. 4.1

(a) **results for test-tube A**
initial temperature = 60 °C

readings / °C
59 58 reading **(i)** 57 57 56 55 55 54 54

results for test-tube B
initial temperature = 61 °C

readings / °C
58 55 53 51 49 47 46 44 reading **(ii)** 42

Read the thermometers **(i)** and **(ii)** in Fig. 4.2 below to complete the sets of results. Write your answers in the spaces provided.

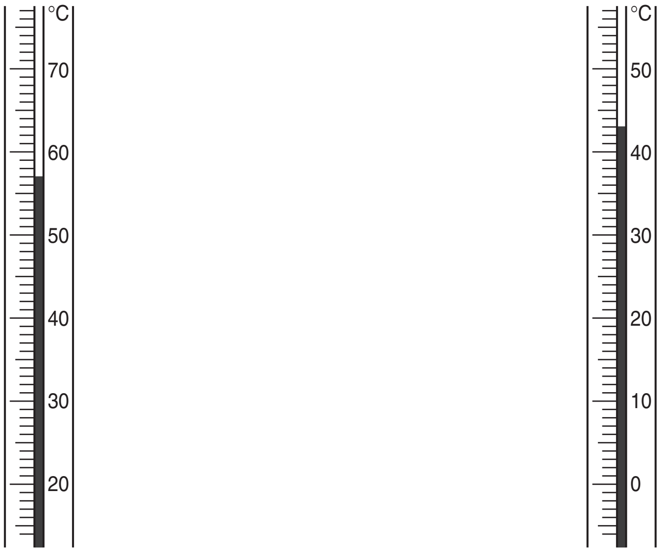

Fig. 4.2

(i) .... °C **(ii)** .... °C [2]

(b) Construct a table showing times and temperatures to display all the results clearly.

[2]

[Turn over

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(c) Which test-tube, **A** or **B**, took longer to cool down?

....[1]

(d) Is huddling effective? Use your results and your knowledge of heat transfer to explain your answer.

....

....

....

....[3]

(e) Suggest **two** ways in which you could improve the accuracy of the experiment.

....

....

....[2]

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5 A student is given substance **X**, which is a mixture of a salt and a metal oxide. Substance **X** is a black solid.
She does the following tests and writes her observations.

(a) Complete the table, Fig. 5.1, by writing the conclusions.

test	observation	conclusion
1. To a small amount of **X**, add 5 cm^3 dilute nitric acid and warm.	blue solution formed	[1]
2. Warm a portion of **X** with 15 cm^3 water in a large test-tube. Filter the mixture and use 2 cm^3 of the filtrate for each of the **tests 3–5**.	black residue in filter paper and a colourless filtrate	
3. To 2 cm^3 of the filtrate from **test 2**, 5 cm^3 hydrochloric acid was added.	colourless solution, no bubbling seen	[1]
4. To 2 cm^3 of the filtrate from **test 2**, a few drops of nitric acid were added, followed by silver nitrate solution.	white precipitate	[1]
5. To 2 cm^3 of the filtrate from **test 2**, about 1 cm^3 aqueous sodium hydroxide was added. The mixture was warmed.	pungent-smelling gas given off, turns red litmus blue	[1]
6. About 10 cm^3 warm dilute nitric acid was poured on to the residue from **test 2**. The filtrate was collected.	blue solution formed	

Fig. 5.1

(b) Suggest another test the student might use to confirm the presence of the gas from **test 5**. What result can she expect for your test?

test ....

result ....[2]

[Turn over

(c) The student thinks that the filtrate from **test 6** might contain copper ions. She tries adding ammonia solution to some of the filtrate.

(i) What will she **see** when she adds a few drops of ammonia solution, if copper is present?

....

....

(ii) What will she **see** when she adds an excess of ammonia solution, if copper is present?

....

....[3]

(d) Suggest what substances are present in substance **X**.

.... and ....[2]

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6 Two students do an experiment to determine the speed of sound in air.
The first student fires a gun at point **X**, 1000 metres away from the second student at point Y.

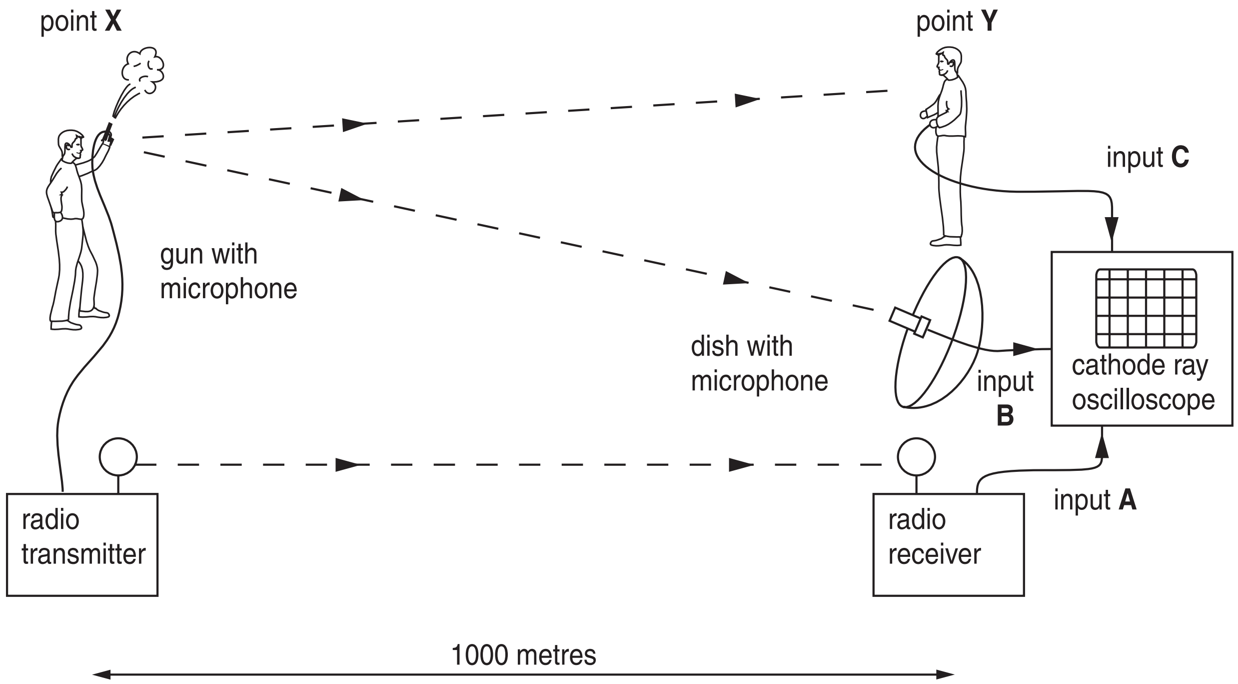

Fig. 6.1

- A microphone on the gun picks up the sound. It sends a signal to a radio transmitter. This signal is sent to the radio receiver at point **Y**. The receiver sends **input A** to a cathode ray oscilloscope (c.r.o.).
- A dish at point **Y** reflects the sound to a microphone in the dish. This sends **input B** to the c.r.o.
- The sound of the gun travels through the air. When the second student hears the sound of the gun at point **Y**, he presses a switch to send **input C** to the c.r.o.

(a) The inputs to the c.r.o. are pulses of energy.
State how the energy travels **from point X to point Y** in each case.

(i) **input A** ....

(ii) **input B** ....[2]

(b) Explain why the microphone at point **Y** needs a reflector dish but the microphone at point **X** does not need one.

....

....[1]

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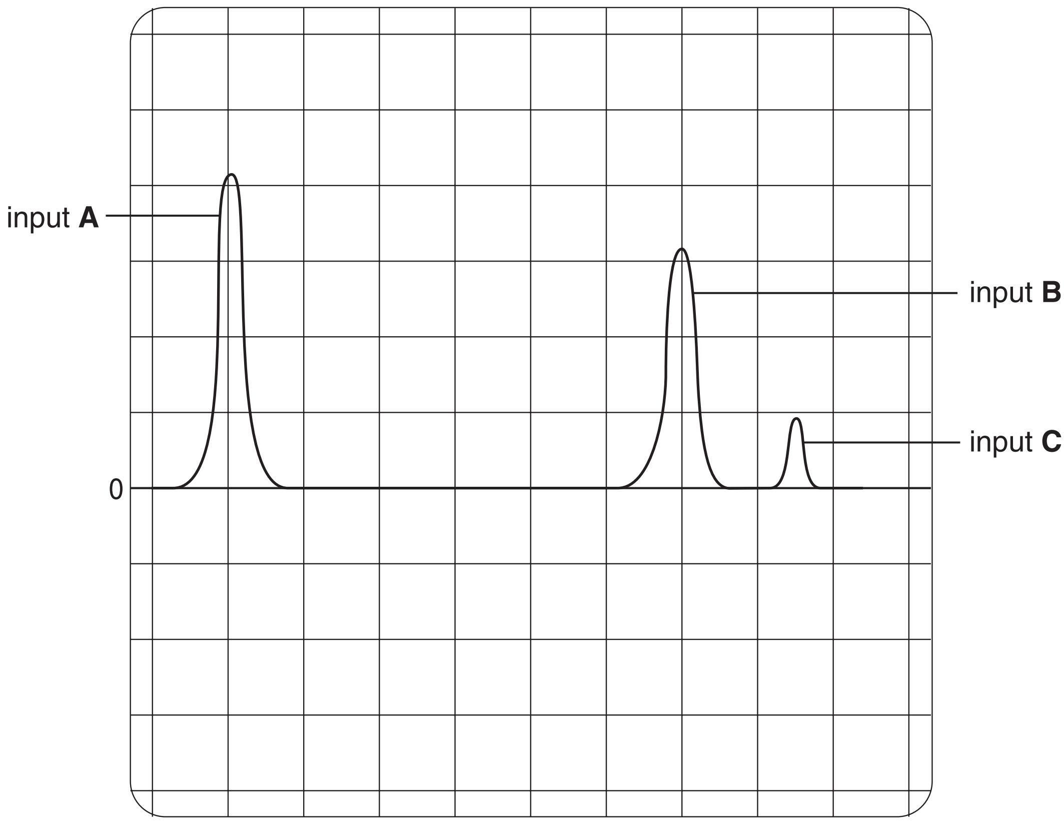
(c) The screen of the c.r.o. is saved and displayed. This is shown in Fig. 6.2.



1 cm = 0.5 s (horizontal axis)

Fig. 6.2

The c.r.o. is set so that 1 cm on the horizontal axis = 0.5 seconds.

Use the information in Fig. 6.2 to determine

(i) the length of time, $\mathbf{t_1}$, between **input A** and **input B**,

$\mathbf{t_1}$ = ...s [1]

(ii) the length of time, $\mathbf{t_2}$, between **input A** and **input C**,

$\mathbf{t_2}$ = ...s [1]

(d) Calculate the speed of sound in metres per second as it travels from point **X** to point **Y**

(i) using $\mathbf{t_1}$ from **(c)(i)**,

speed of sound = ... m / s [1]

(ii) using $\mathbf{t_2}$ from **(c)(ii)**,

speed of sound = ... m / s [1]

(e) Which result, **(d)(i)** or **(d)(ii)**, for the speed of sound is more reliable? Explain your answer.

....

....[2]

(f) How can **all** of the results from this experiment be made more reliable?

....

....[1]

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